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Preparation and Electronic Characterization of Substrate-Scale MoS_2 Single-Layer Films JOSEPH MARTINEZ, MICHAEL GOMEZ, MIKE VALENTIN, EDWIN PRECIADO, VELVETH KLEE, ARIANA NGUYEN, ADAM BERGES, DANIEL LU, MIGUEL ISARRARAZ, LUDWIG BARTELS, University of California Riverside — Using a novel high vacuum chemical vapor deposition process we synthesize substrate scale (2x2 cm) homogeneous monolayer MoS_2 films. Our process involves exposure of a hot Mo filament to organic chalcogen precursors that volatilize MoS_x species which then precipitate on a thermally-controlled substrate. The resultant films are photoluminescent at 1.87 eV as expected for monolayer material; their Raman modes are indistinguishable from exfoliated material. Metal contact formation to these films was investigated under UHV conditions utilizing X-Ray Photoelectron Spectroscopy. These measurements permit us to follow the formation of a Schottky Barrier with increasing metal film thickness on the Angstrom scale. We utilize core level spectroscopy to indicate the evolution of the MoS_2 valence band under metal deposition. Our measurements provide direct indication on the charge transfer direction at metal contacts and the ensuing band-bending in two-terminal devices.

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